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Journal of the Society of Arts.

FRIDAY, OCTOBER 8, 1858.

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ARSENIC IN PAPER HANGINGS.

The following extracts are taken by permission from the unpublished work "On Poisons," by Dr. ALFRED S. TAYLOR, F.R.S., accompanied by remarks by that gentleman:—

"There is one form of chronic poisoning by arsenic on which it will be proper to make a few remarks, as the real cause may remain wholly unsuspected. Arsenic is largely employed in this country, under the form of emerald green (aceto-arsenite of copper), and of orpiment in the manufacture of decorative papers with which the walls of sitting and bedrooms are covered. Some persons have suffered from symptoms of chronic poisoning by arsenic, in which no other cause was apparent than the continued respiration of the air of their rooms, charged probably at times with a fine arsenical dust. On examining the papers, they will be found in some instances loaded with arsenic, laid on in a rough and coarse manner, so as to be easily removable by friction. Arsenic is thus used in imparting a green tint to some of the most costly as well as the cheapest decorative papers. It is a practice fraught with danger in more respects than one, and under a proper system of medical police, it would not be permitted. In the kingdom of Prussia, the use of these papers is strictly prohibited. If there has not hitherto been much complaint on the subject, it may be attributed to the fact that the cause has not been suspected. Many obscure cases of illness, referred at the time to constitutional and other causes, may probably have been due to the effects of arsenical dust thus inhaled day and night by those who inhabited the rooms. Dr. Hinds, who suffered from the effects himself, has described two cases in which the prominent symptoms were prostration of strength, headache, thirst, loss of appetite—an inflammatory state of the conjunctivæ with heat and dryness of the fauces. (*Medical Times and Gazette*, May 23, 1857, p. 521.) A portion of the paper of the room in which these persons lived was sent to me, and on examination I found in the green pigment spread over it, a large quantity of arsenic. These facts should at least be borne in mind in cases in which it is suspected that poison is being secretly administered to another.

"Dr. Traill met with a case in which a child aged three years suffered severely from symptoms of arsenical poisoning, owing to its having sucked some slips of paper coloured with this green pigment; some of the paper, still retaining a green colour, was passed in the motions. The child recovered (*Edinburgh Monthly Journal*, July, 1851, page 1.)

"Among other uses of this noxious compound, we find it employed for imparting a bright green colour to the shelves of bakers' and green-grocers' shops. An incident which occurred to myself will show that food may thus acquire an arsenical impregnation. Several loaves of bread were supplied to me, having upon the undercrust a quantity of green-coloured pigment, which on analysis turned out to be arsenite of copper, containing about fifty per cent. of arsenic! On inquiry, I found that the baker had recently painted the shelves of his shop with this pigment, and the hot loaves placed upon them had taken off a portion of the arsenical paint. It is easy to conceive that an accident of this kind, if undetected, might lead to serious results, and perhaps to very erroneous suspicions. (*Medical Times and Gazette*, April, 1854, p. 326.)

"Another alleged form of poisoning by this substance which has attracted some attention, is in the state of vapour or fine dust applied to the membrane of the lungs, or in the state of powder as applied to the skin. In the former edition of this work the following case was related. A young man, after having been engaged for nine days in printing with an arsenical green pigment, was seized with irritation and watery discharge from the nose, swelling of the lips and nostrils, and headache. The next day he experienced severe colic, and great muscular weakness; but these symptoms disappeared in about eight days. It is probable that, in this case, the arsenite of copper had been taken into the body in the state of fine powder. (See Arsenical vapours, ante, p. 426.) I have since been informed, that the persons who manufacture and hang the coloured paper on walls, suffer from boils, inflammation of the eyes, and other symptoms of irritation. In one case now under treatment, pustular tumours have shown themselves on the wrists and ankles, and there is excessive sensitiveness and irritability of the skin. If removed the patients soon recover. In a former page I have alluded to the mysterious deaths of a whole family (see cases of the Arzone family, ante, p. 120). The father was a pigment-manufacturer, and there is great reason to believe that he and his family fell victims to the respiration of arsenical dust or vapours. According to M. Bouchardat (Annuaire de Thèrapeutique, 1846, p. 209), the workmen who handle the emerald green in making the papers, are subject to serious disorders of health. They sometimes suffer from eruptions of the skin—one of the local effects of poisoning by arsenic (see *Assoc. Med. Journal*, 1856, Sept. 6, p. 371, 757; Sept. 20, p. 810, and ante, p. 371), with œdema (watery swelling) of the face, and boils frequently forming in the scrotum. There is irritation with discharge of fluid from the mucous membrane of the nose, and abundant salivation. In the more advanced stage, there are colicky pains, headache, and prostration of strength. (See Ann. d'Hyg. 1847, ii. p. 56; and *Journal de Chimie*, Juillet, 1858, pp. 394, 397.)

"More than ten years since, Dr. Martin announced that the use of this arsenical green in oil-paint had an injurious effect upon those who inhabited apartments recently painted with this substance. Four pounds of Scheele's green had been used in painting the walls of a low damp room. In a few days a putrescent and highly disagreeable odour was perceptible. When the windows were closed, those who remained in the room experienced headache, pain in the chest, and other disagreeable symptoms. The colour was scraped from the walls, and the room was then inhabited without any of these unpleasant symptoms being observed. Dr. Martin attributed the effects to the production of arsenuretted hydrogen. The poisonous salt may, however, have been itself carried off in vapour, like white lead, under similar circumstances, by the oil of turpentine. In a note attached to this case, it is stated that since the mixed acetate and arsenite have been substituted for carbonate of copper in painting the walls of rooms, many persons who have slept in rooms painted green, have complained in the morning of headache, nausea, dryness of the mouth and throat, and cough. The symptoms went off during the day. In one instance the foul odour was referred to mice, and the wainscot was about to be removed, when a suspicion arising that it was owing to the green colour used as a pigment, this was removed, and the smell disappeared. (*Gaz. Méd.* 13 Fev., 1847, 130.)

"I have elsewhere referred to the probable effects of wall-papers loosely covered with the aceto-arsenite of copper (ante p. 364). This pigment contains fifty-nine per cent. of arsenic, and from some of these papers the noxious material may easily be scraped or removed by friction. A square foot of the paper may yield from twenty-eight to seventy grains of the arsenical pigment, and in rooms exposing five or six-hundred square feet, a large quantity of arsenic is thus distributed over an extensive surface. Dr. Hinds, of Birmingham, noticed, that in occupying a room which was covered with a wall-paper of this kind, he suffered from severe depression, nausea, pain in the abdomen, and great prostration of strength. These symptoms appeared every evening that he sat in this room: this led him to suspect that they were connected with this room, and on examining the paper he found in it a quantity of arsenic. (*Lancet*, 1857, vol. i., p. 193). Two other cases occurred in his practice, where similar symptoms were produced in a man and his wife, under similar circumstances. To these I have elsewhere referred (ante, p. 365). Dr. Halley, of Harley-street, suffered from constant headache, dryness of the throat and tongue, with internal irritation. In about three weeks, he became completely prostrated, and was threatened with paralysis of his left side. He called on me and described his symptoms, bringing, at the same time, a portion of the wall-paper of the room in which he was in the habit of sitting; and this I found to be loaded with arsenic. He removed the paper, and since then has recovered his health. Several cases have since come before me, in which, whether real or imaginary, symptoms of a *similar* kind have been referred by persons to the habitation of rooms papered with the arsenical green. At the same time, there have been many cases in which the occupation of rooms thus papered has been attended with no injurious effects. This fact, as well as a few imperfect experiments, have led some persons to affirm that the arsenical papers have not produced the effects ascribed to them. (See *Pharmaceutical Journal*, April, 1858, p. 520, and May, 1858, p. 554). The connexion of cause and effect, however, appears to me to be too plainly made out in the cases of Dr. Hinds and Dr. Halley, to be set aside as a mere coincidence. The symptoms in both cases were similar, and such as arsenic is well known to produce; there was no other source of arsenic, and no other cause to explain them; and they entirely ceased on the removal of the arsenical paper. It may not be easy to detect arsenic in the air of a room thus papered, but then it is equally difficult to detect lead in the air of freshly painted rooms, in which persons have been paralysed by passing a night. In the year 1837, and subsequently, arsenic was largely used in the manufacture of a spurious kind of wax-candle. The workmen suffered from boils and other disorders, and some who occupied rooms in which such candles were burnt, complained of symptoms like those of arsenical poisoning. As in reference to the arsenical papers, it was alleged,—because arsenic could not be detected in the air of a room, and all persons did not suffer from the use of the candles, that the illness was owing to some other cause. Although there are difficulties in explaining how it happens that more accidents do not occur, it appears to me there is already sufficient evidence to justify an enforcement of the Prussian regulation prohibiting the use of arsenic for such a manufacture, or in allowing the paper to be sold only on the condition that the words "arsenic, posion," are stamped upon it. (See *Pharm. Journal*, May, 1858, p. 553.)

"Dr. Böcker of Bonn, one of the most recent writers on Toxicology, refers to the effects of chronic poisoning produced on persons inhabiting rooms of which the walls are covered with arsenical paper hangings, and states, that on several occasions he has been called upon to treat such cases. A removal of the cause has generally proved sufficient. Dr. Böcker considers that a damp state of the wall renders them injurious. (Die Vergiftungen, 1857, p. 132.)"

Note.—I append an abstract of a notice issued by the Prussian government in reference to arsenical paper-hangings on the 3rd September, 1857. (Cuspers Vierteljabrschrift für Gerichtliche Medicin, Januar 1858, p. 184, Art, xxiii.)

"The Board of Police cannot too strongly impress on the public, the danger to health arising from the use of arsenical colours, especially in the habitation of rooms the walls of which are painted with such colours, or are covered with arsenical paper-hangings. The breathing of the vapours (air) in such rooms, has produced all the effects of slow poisoning by arsenic, namely, disordered digestion, difficulty of breathing, cough, colicky pains, weakness of the muscles, trembling and loss of power in the limbs, falling off of the hair, abscesses in the skin, emaciation, a wasting fever, and death. In removing arsenical papers from walls, they should be first well washed with salt-water, as the respiration of the arsenical dust may cause serious symptoms or death. The Board of Police earnestly entreat all medical men in their respective districts to advise the removal of arsenical colours from the dwellings in which they may be used.

"Konigl Polizei, Præsidium.
"Freiherr V. Zedlitz, Neukirch.
"Berlin, 3rd Sept. 1857."

Remarks.—It is not my intention to take part in the controversy which has arisen on this subject. It appears to me that it is leading the minds of the public from the true subject at issue. Mr. Phillips may be right in his conclusion that he could detect no arsenious acid in the air of a room covered with these poisonous paper-hangings; and "Crystallographer" may be right in assuming that the octahedral crystals seen by Dr. Halley may not have been arsenic but "miscroscopic diamonds" derived by some mysterious process from the carbon of the paper, or of the atmosphere. The question is not one of chemistry or crystallography, but really one of pathology. Certain symptoms, unquestionably those of arsenical poisoning, have arisen in certain persons who inhabited rooms of which the walls were covered with these papers. They have existed with the papers; they have disappeared on their removal. These facts are perfectly in accordance with those collected by the Prussian Government, and which have induced that Government authoritatively to prohibit the use of these paper-hangings.

Mr. Phillips brings forward his own case and that of his family, as a proof that the use of such papers is not noxious or injurious to the health. It would be easy to produce cases from the arsenic works of Cornwall, to show, by the exemption of some workmen, that the vapours of arsenic were *not* poisonous; and, from white-lead works, cases which show that many workmen do not suffer from lead poisoning; but it is well known that we are not all constructed alike in reference to the effects of poisons, and it is just possible that there may be a susceptibility to the action of arsenic in a few, while the majority may escape.

I must, however, express my surprise at Mr. Phillips's conclusion, which appears to me substantially to admit the great danger to which the use of these papers in our dwellings must expose us; whilst at the same time, his paper is leading the public to believe, because he found no "octahedral crystals," that there is no danger at all.* He says:—

"In conclusion, I beg to express my opinion that no danger need be apprehended from a paper such as the one annexed, in which but a small proportion of the surface is unglazed, provided ordinary care be used when removing the dust from the walls, but that even if such care were not exercised, it is doubtful (!) whether any pernicious effects would be felt by those inhabiting the room."†

The question immediately suggests itself—What will happen in the dwellings of those who cover their walls with cheap arsenic papers entirely unglazed? One of these I have now before me, and the arsenical pigment is rubbed off the surface with the slightest friction. Again, it would appear from his statement that even the glazed arsenical papers must be dusted with care. The breathing of the green dust of arsenite of copper may be just as fatal to life as the breathing of microscopic crystals of white arsenic; and, supposing that by careless dusting, &c., the poisonous material is diffused in a room, and is breathed by persons inhabiting it, it is by no means doubtful but certain what the effects would be.

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* Leading article in *Daily News*, Sept. 1st, 1858.

† *Journal of Society of Arts*, August 27th, 1858, p. 607.

I am one of those who think that the fine and impalpable dust which is diffused through a room by currents of air, mechanical agitation, &c., is derived from the material on the walls as well as from the floor and ceiling. The walls generally present twice the extent of surface. If the powder on the walls is of an arsenical nature, it is not easy to perceive how, apart from the mechanical dusting of domestics (indispensable in most houses), we can prevent the occasional diffusion of a poisonous dust in an impalpable state. We are only made conscious of the existence of this diffused dust by the striking of a sunbeam across an inhabited room. They who prefer the "cheerful" green of an unglazed arsenical paper must, therefore, according to Mr. Phillips, be prepared to incur some risk—care must be taken that the walls are not too frequently or roughly dusted!

I have found, with respect to some of these papers, that they contain arsenic in a form soluble in water, and that in mixed patterns, parts of the papers surrounding the arsenical green colour are impregnated with arsenic. By scraping the arsenical pigment from the surface, or by soaking slips of the paper in water, the means of poisoning are always at hand. During the last summer I caused some of the arsenical paper to be moistened with water containing a small quantity of sugar. Flies which settled upon it were rapidly killed. As an objection to legislation for restricting the sale of arsenic, it was stated by a well-known pharmaceutist that arsenic might be easily procured for criminal purposes by scraping the walls of almost every dwelling house! This is an additional point for consideration in reference to the domestic use of this dangerous pigment. We require strong restrictions on the procuring of arsenic from a druggist's shop, and at the same time place the poison within reach of any evil-disposed person under such circumstances as to ensure secrecy of possession and use. A square foot of this paper contains enough arsenic to poison five or six persons.

In your *Journal*, Vol. v., p. 652, and Vol. vi, p. 606, you have made a reference to my evidence on this subject before a Committee of the House of Lords. I may mention to you that the inquiry arose under these circumstances. Their Lordships desired to know what became of the large quantity of arsenic manufactured in and imported into this country. I informed them that a very large proportion was spread in the form of pigments over the walls of our dwelling houses. I have since learnt that one London manufacturer alone was in the habit of using about *two tons of arsenic per week* in the production of this green pigment for paper-hangings! Its cheapness and durability as a colour recommend it strongly to public notice. Since the evidence which I gave before the Committee of the House of Lords, fifteen months ago, I have had still stronger reasons for holding the opinion then given respecting the danger attending the use of these papers. Mr. Phillips suggests glazing and no dusting. I would suggest that some other green colour should be selected, even at a little more cost. If the manufacture of arsenical papers is to be continued, the Prussian poison-symbol of a skull and cross-bones, with the motto *memento mori*, should be printed as a pattern upon it—or, at least, it should be intimated to all who purchase the paper-hangings that they contain arsenic.

ALFRED S. TAYLOR, M.D., F.R.S.

15, St. James's-terrace, Regent's-park,
September 27, 1858.

The following paper, by Dr. William Hinds, bearing immediately upon the same subject, is extracted from the *Pharmaceutical Journal* for the 1st inst.:—

Certain carefully-prepared papers, which recently appeared on the above subject in the pages of the *Pharmaceutical Journal*, not having been, as far as I am aware, fully replied to, I beg to offer to the readers of the above interesting journal a few observations on this subject. Great confusion of ideas seems to prevail extensively as to the facts brought before the public, while even the deleterious influence is itself denied in some quarters. It is by no means uncommon to see theoretical denials and disputes by some persons, in reference to facts and truths, which are nevertheless characterised by such stern features as to be realised *as* facts and truths by others. The views advanced by myself and others as to the injurious effects of arsenical papers in rooms, I believe to be unquestionable. Arsenite of copper, as a poisonous pigment, I find frequently recognised by writers on medical jurisprudence; but so far as I have been able to learn, to Dr. Alfred Taylor belongs the merit of more especially commenting upon the dangers to be apprehended from its employment. In his invaluable work, Dr. Taylor gives a case, in which "a young man, after having been engaged for nine days in printing with this arsenical green, was seized with caryza, swelling of the lips and nostrils, and headache. The next day he experienced severe colic and great muscular weakness." Dr. Taylor adds the valuable remark, that "in this case the arsenite of copper had been taken into the body in the state of fine powder."

This shows that Dr. Taylor's attention had been specially drawn to the subject. At the same time I may remark, that to the best of my knowledge, no case of actual poisoning had ever been made public, as having occurred from simply inhabiting a room hung with the arsenical paper, until my own case was published in the *Medical Times and Gazette* in February, 1857. The accident occurred to me as far back as 1849; but the case being, as I then thought, so unique and unparalleled, I hesitated to publish it until I had had means of collecting other cases, or until a favourable opportunity.

The way in which I was led, step by step, to certain conclusions as to the injurious effects, and also a description of these effects, are given exactly as they occurred in the paper mentioned, and to which I beg to refer those who may feel an interest in this subject.

In the next cases which came under my notice, the moral force of the evidence was so strong, as to satisfy the most sceptical. The injury occurred to a Mr. Simpson, of this city, and to his wife. Mr. S. had enjoyed the best health until he had a green flock paper put on the walls of two sitting-rooms. In a very few days he experienced all the symptoms of slow arsenical poisoning, but without either believing in, or even suspecting the cause. He became seriously ill, as also did his wife; and a fine parrot, which was hung in one of the rooms, all at once drooped and refused food. At this stage a gentleman, who had known of my own case, suggested a solution of the mystery as to the cause of the illness, but Mr. S. repudiated the supposition. He then left town for his health, returning in a fortnight quite strong and vigorous, and confident he should continue so. In several days he became again seriously ill, and after long residence, he became deeply convinced, by the very force of circumstances and suffering, that the cause lay in the wall paper. He underwent the expense of an entire removal of the paper, and soon after all were well. The gentleman here mentioned, would, I am sure, be glad to give his experience to any person who might be sceptical as to the facts.

Mr. S.'s case is fully detailed, without names, in the scientific journal before mentioned, for May, 1857.

In the case published by Dr. Halley in the *Times* newspaper, the facts and results are as striking and forcible as in the other published cases.

I have to say one word as to the mode of escape from these arsenical papers of the poisonous colouring matter, and I must observe that a vast deal of entirely irrelevant speculation and equally futile experiments have been expended, with a view to disprove facts, about which it is astonishing that any reasoning person can have a just doubt. A sample of this irrelevancy I will presently mention.

I find papers in this journal for May and June, evidently from able contributors, denying our conclusions, which the space I could request would not enable me extensively to notice. For this, however, there is the less necessity, inasmuch as these writers give but negative results for the most part. I believe I am justified in saying that our positive facts and forcible moral evidence are not shaken by mere negative results, and miniature and usually irrelevant experiments. Neither is the question a mere chemical one, to be easily decided in miniature. The existence of the poisonous ingredient upon the paper is admitted, though one gentleman seeks to spoil this admission, by asserting (truly enough) that the flock portion is a mere dyed stuff, and contains nothing injurious. The injurious effects, moreover, of arsenite of copper, when inhaled, are equally admitted. Now, that mere water-colour pigment, without an overcoat of varnish, will give off, under certain hygrometric conditions, particles of its dust to the atmosphere, is perhaps so self-evident as not to require any laboured proof. The fact is indeed unquestionable. Take a feather or a soft white napkin, and run either never so lightly over a green paper of the ordinary kind, after it shall have been placed upon a wall by means of paste, and myriads of particles of the colour from the surface will adhere. Much, of course, is sent floating in the atmosphere of any room by the least possible disturbance of its contained air, as by draughts or the opening of doors. These particles will be then breathed into the lungs, and produce all the symptoms which have been described. A great deal has been said about volatilisation of arsenic and arsenical vapour, but it is not all to the purpose. Dr. Taylor's idea, as given in this journal for May last, and the same as it presented itself to me in the first case published, is, I believe, the only rational one—namely, that the finer and lighter particles of the colour escape as such. Now, what is the *dose* of this fine powder of Scheele's green necessary to produce bad symptoms? That is a question to which I cannot give an answer. Probably it is extremely small in quantity. Dr. Taylor, whose labours place him at the head of his department, in this country at least, has not attempted, so far as I know, to give a reply to this question; and the means by which the deleterious particles become active in the system, present several difficulties not easily to be solved.

There is one experiment I would beg to urge strongly upon the gentlemen who are sceptical as to our facts. It is that they should place themselves in the same conditions as those under which our facts were gathered. I shall be happy to furnish any gentleman who may wish to make the experiment, with samples of arsenical paper from which to select. Let a room be papered with one of these, and let the experimenter undergo the same experience as we who have suffered, and I shall have little doubt that he will come out of the trial fully convinced. It would be still better to make a series of trials, in order to avoid any incidental negation.

I may here mention the fact of the universal testimony of workmen who have been in the habit of hanging green papers, to the often severe symptoms which they experience while at work. One most powerful man, a paperhanger, told me he has repeatedly got so ill with caryza, dryness of throat, and prostration, while hanging green paper, that he has been compelled to leave the room, and become unable to finish his work. This man could tell me himself that green paper was very injurious, though he was surprised to be told that the colour was arsenical. It is a fact worthy to be borne in mind, that in all these cases the *symptoms* were of the kind indicative of slow poisoning—namely, gastro-enteritic irritation, with intermittent colicy pains, nausea, prostration, loss of muscular power, caryza, heat, and dryness of throat; and, moreover, that in every case the cause was at first entirely unsuspected by those who suffered. In my own case I had not previously given the least notice to the colour of the paper, and did not trouble myself with any examination of it. It was only after suffering illness that my attention was gradually attracted to every altered condition of the room in which I sat to read. I had previously used the room for years with no inconvenience. The symptoms came on in three or four days after the papering. They ceased on my ceasing to occupy the room. They recurred every time I had for some hours again used it, and they never after appeared after the room was stripped of the injurious paper. The very same conditions, or very similar, were experienced by Dr. Halley, whose communication on the subject appeared in the *Times* of the 11th of January of the present year; and the same also in Mr. Simpson's case, to which I have before alluded.

I will now give a specimen of the "experiments" by which the facts we bring forward have been met. Several experiments have been detailed in this journal by Mr. F. A. Abel. I desire to be entirely just to Mr. Abel's efforts, but I cannot think his scientific knowledge was present to him at the time of those experiments. I will explain my meaning. On coming to the seventh experiment, Mr. A. makes the following most remarkable statement. He says: "It should be mentioned that in all these experiments, the *tube* was plugged with cotton wool." Now we refer to the other conditions of these experiments, and we find that the *temperature* is raised to only 90° on the one hand, and on the other, the tube was plugged with cotton wool, to allow no particles to escape mechanically! Mr. Abel will forgive me for reminding him of a fact he already knows—namely, that arsenic can only be volatilised by heat at a temperature of 380°; and yet he sticks to 90°, and plugs the escape-tube with cotton-wool, to prevent the mere mechanical passing of arsenic. I am sure Mr. A. will see the entire inconsistency and inapplicability of his whole experiments, on a reconsideration of the subject.

In Mr. Dugald Campbell's experiments, given with candour and clearness, the conditions were essentially different from those in which arsenic is given off in a room; for while the 140°, the highest point to which Mr. C. raised the temperature, were less by no smaller a quantity than 240° than the temperature required for the volatilisation of arsenic; a square foot only of paper, and *confined in a bottle*, is a very different thing from a square foot, indeed I might add 500 square feet, or 1000, pasted upon a wall, and subject to certain important hygrometric transitions, which favour the loosing of the colour, and its escape into the atmosphere of the room.

Some observations have also been made in the journal by Mr. B. H. Paul, and are given with great candour. Those remarks contain no experiments on the subject in question, and, as they are directed more especially against the gratuitously-conceived theory of vaporisation of pure arsenic by heat, inapplicable in the present case, require little remark. In conclusion, I may express my regret to perceive how completely an ascertained fact, as communicated by Dr. Taylor, in reference to the actual observance of particles of Scheele's green upon a slip of glass, can be ignored by a mere surmise.

BRITISH ASSOCIATION, LEEDS, 1858.

On the Progress of Mechanical Science.

The following is the Inaugural Address "On the Progress of Mechanical Science," delivered before the Mechanical Section of the British Association, by William Fairbairn, F.R.S., President of the Section:—

In opening the business of this section of the British Association, I have to congratulate you upon the encouraging prospects which our meeting in this great mart of industry is calculated to afford. This large and important district is only just recovering from a state of intense excitement and a burst of loyalty that have reverberated from one extremity of the Riding to the other. In these rejoicings I have naturally taken a deep interest, and now that the royal visit is over, a meeting for the extension of science and useful art is probably the most appropriate conclusion of the festivities which have occupied the attention of this town for the last two weeks.

On a former occasion, when I had the honour of occupying the chair of this section, I endeavoured to combine in a condensed form such improvements in mechanical science as had been effected during the successive intervals between the annual meetings of this Association, and conceiving that a short account of what has taken place during the last few years may not be unacceptable, I have on this, as on previous occasions, ventured to direct your attention to a succinct retrospect of what I consider new and valuable in mechanical art.

In mechanical science and general engineering this country continues to maintain its high position in new developments and continued progress; and the almost innumerable patents weekly taken out under the new law, are remarkable indications of the activity and inventive power of the country. It is not yet thirty years since the introduction of malleable iron as a material for shipbuilding, and a much shorter time has elapsed since it was first applied to the construction of bridges. We have all of us heard of the tubular system so successfully applied to the bridges across the Conway and Menai Straits, and now it is extensively employed in every quarter of the globe. There is no span within the limit of one thousand feet, but which might be compassed by the hollow-girder bridge with security and effect. These discoveries are of immense importance to mankind, and where they are carried out with skill and a strict adherence to sound principles of economy and science, they give to the engineer of the present day a power which in former times it was impossible to realise.

STEAM NAVIGATION.—In this department of practical science, although much has been done, yet much remains to be accomplished in giving to the iron ship uniformity of strength and security of construction. In vessels of such complex form, bounded by such a variety of curved surfaces, we are yet much at sea as to the precise points of application of the material, in order to attain the maximum of strength combined with lightness and economy. These are data yet to be ascertained, and it will require long and laborious experimental research before the facts are clearly known and established. Much has, however, been accomplished in the absence of these data, and I may safely refer to that noble structure, the *Leviathan*, which, with all her misfortunes, is, nevertheless, a most magnificent specimen of naval architecture. The cellular system, so judiciously introduced by Mr. Brunel, is her great source of strength; and I am persuaded that she will stand the test (which I have recommended in other cases) of being suspended upon the two extreme points of stem and stern, with all her machinery on board. Or, these conditions being reversed, I believe she may be poised upon a point at her middle, like a scale-beam, without fracture or injury to the material of which she is composed. Her cellular construction and double sheathing round the hull, and the same formation on the upper deck, give to the vessel enormous powers of resistance, and her division and subdivision by bulkheads ensure a large margin of security, in whatever circumstances she may be placed. In fact, she may be considered as a large hollow girder, requiring a load of nearly 10,000 tons suspended from the centre to break her. I mention this to show that her want of success is not due to any want of success in the ship herself, but to the magnitude of the speculation as a commercial transaction, and her unmanageable character in regard to the shipment of cargo, and similar difficulties which she may be called upon to encounter. I hope, however, that the necessary funds will be forthcoming, and that we shall yet see her dashing aside the surge of the Atlantic at a speed of eighteen or twenty knots an hour.

RAILWAYS.—The magnitude of this great republic (as it is called) of speculation and industry is scarcely, if ever, appreciated by the public. We look at the locomotive of the present day, or glide by its means over the surface of the earth, without once thinking of the amount of skill and of capital expended in the production of such vast and important results. At the present moment we learn from returns recently published, that we have in this country alone 9,500 miles of railway executed and in actual operation. And, taking at a rough calculation one locomotive engine of 200 horses power to every three miles of railway, and assuming each to run 120 miles a day, we thence calculate the distance travelled over by railway trains to be equal to 380,000 miles per day, or the enormous distance of 138,000,000 of miles per annum, a space measuring the distance of the planets, and beyond the conception of those not conversant with figures. To transport engines and trams this distance, requires a force equivalent to that of upwards of two hundred thousand horses in constant operation throughout the year.

As regards the commercial value of railways, it will not be necessary to enlarge upon it in this place. Suffice it to observe that a clear revenue of £12,000,000 is left, after all expenses are paid, for distribution amongst shareholders and creditors. This amounts to 3¾ per cent. per annum, a small return upon £320,000,000, the original cost of 9,500 miles of railway, an average of £34,000 per mile.

In the locomotive engine there has been no improvement of importance during the last two years, excepting only its adaptation to burning coal instead of coke, without the production of smoke. To a certain extent this has been successfully accomplished, but the process is still far from perfect. Superior training is wanting for engineers and stokers before we can look forward with certainty to the time when the use of coal will become general, with increased economy and with the suppression of the nuisance of smoke.

In the formation of the permanent way considerable improvements have been effected, especially in the jointing of the rails by what is termed the fish-joint, which secures a more perfect union of the rails, produces a smoother surface, and diminishes the wear and tear of the rolling stock, when compared with the old system of jointing, so sensibly felt in carriages running over the line at great velocities.

MANUFACTURES.—For the last twelve months, great depression has existed in this department of the national industry, and notwithstanding the attempts to cheapen the production of the staple articles of manufacture, by the introduction of improved machinery, there still exists a considerable depression in many of the great marts of industry. This is probably to be attributed to the disturbed state of India and China, but looking at the native activity of the manufacturing population, and the amount of capital employed, there has been no serious diminution in the production of manufactured articles, nor any stagnation in the demand for labour. On the contrary, I believe, with the exception of the causes just alluded to, that the manufactures of this country were never in a more flourishing condition.

In the iron trade, with which this section is more immediately connected, there has been a similar but slight depression, the manufacture of pigs, plates, and bars being as great as in any former year; and taking into account the improved process by which malleable iron and steel is now produced, there is reason to hope for a greatly increased demand and an enlarged production. In fact, such have been the improvements since Mr. Bessemer first announced his new process of boiling the crude iron direct from the smelting furnace, and dispensing with the puddling process, that we appear to be now in a state of transition from the old system of smelting, refining and puddling, to a more direct, continuous, and improved process of manufacture.

Steel bars and plates are now made without the intervention of an intermediate and tedious process, and we may reasonably look forward to the introduction of an entirely new article of manufacture of greatly increased powers of resistance to strain. Although, hitherto, Mr. Bessemer has not succeeded in producing malleable iron by his new process, he has made beautiful refined iron, and has stimulated others to attempts at improvement in the same direction. His discoveries, first given to the world through this section of the British Association, have already proved of great value to the community, and we look forward with confidence to the introduction of still greater improvements—improvements by which steel plates and bars will be produced at almost the same price as we can now obtain the best manufactured iron.

The Machinery of Agriculture.—This is a branch of mechanical art which requires the careful consideration of the mechanician and the engineer. The time appears to have arrived when the introduction of machinery, combined with the wide diffusion of education amongst our agricultural population is absolutely necessary, and in my opinion, increased intelligence, together with new machinery, will double the production of the soil and improve the climate in which we live. Much as has already been done, very much has yet to be accomplished; we must persevere in the new processes of deep draining and subsoil ploughing, and in the substitution of steam power in place of horse and manual labour, before we can realise such large and important advantages as are now before us. Great changes and improvements have been effected in my own time, by the introduction of new implements to relieve the labours of the farm. Everything cannot, however, be done by the mechanician and engineer; much has to be done by the farmer in the preparation of the land to render it suitable for machine culture; and a willing heart as well as a steady hand is required of the agriculturist before he can work in concert with the engineer. The reaping machine has now attained such a degree of perfection as to bring it into general use on lands prepared for its reception, and the steam plough is making rapid strides towards perfection, and is likely to take the place of horses, and effect a change as beneficial to the farmer as it will be advantageous to the public at large.

Electric Telegraphs.—The consummation of telegraphic communication between the old and new worlds is the crowning triumph of the age, and I hail, in common with every lover of science, the immense benefits which the successful laying of the Atlantic cable is calculated to secure for mankind. It is another step forwards in the great march of civilisation, and the time is not far distant when we shall see individuals as well as nations united in social intercourse through the medium of the slender wire and the electric current. These are blessings which the most sanguine philosophers of the past never dreamt of. They are the realisation of the age in which we live, and I have to congratulate the section on what has already been done, and upon the benefits yet in store for us in the wide, and, to some extent, unexplored field of this wonderful discovery.

Telegraphic Cables.

The following is an abstract of a paper on the construction of Telegraphic Cables, read by Mr. Macintosh, before the same Section:—

In coating conducting wires with gutta percha or other insulating material, by means of rollers, each roller is grooved in its periphery, the grooves meeting to form an eye the size of the covering desired. Against the rollers are placed hoppers, in which the insulating material is placed in a warm plastic state. The gutta percha enters and fills up the grooves of the rollers, and where the rollers come together the insulating material in the grooves is brought together, firmly enclosing the conductor. The great strength and protection of these cables are obtained by embedding fibres of flax, hemp, or cotton, in an outer layer of insulating material. This is done with great pressure, which prevents the possibility of the insulating material ever separating. The cables so made are all cold vulcanised, by passing them through chloride of sulphur and a solvent, or through sulphuric acid and water, as they are made; this process thoroughly closing up the pores, and rendering the cables much less liable to be injured by heat or abrasion, and effectually preventing the decomposition of the gutta percha or Indian rubber.

In submerging these cables, they are passed through a canvass tube full of hard wood balls, and attached to the stern of the paying-out vessel by strong vulcanised Indian rubber springs, which prevents any injury to the cable in depositing it in the sea.

As these cables are made by machinery, they can be made in hundred-mile lengths or more without joints.

Leeds Exhibition of Local Industry.

The following is a notice of some of the articles shown in the mechanical division of the Leeds Exhibition of Local Industry, read before the same section by Mr. Joshua Buckton:—

On entering the shed specially set apart for such things, we notice a fine collection of malleable iron, boiler plates, and angle iron, as used in shipbuilding, from the Monk Bridge Works; locomotive crank and other axles in the forged and finished state, from the Clarence, the Leeds, the Farnley, and the Kirkstall Forge Company's Works; many wheel tyres with their uses shown in various forms, and fractures showing the grain and quality of the metal.

In the stand of the Kirkstall Forge Company is seen a beautiful model of a weighing crane, designed for raising and weighing heavy goods at one operation, thereby saving time and an immense amount of labour; the weighing being accomplished by a peculiar and simple adaptation of the principle of the steel yard. The apparatus can be disengaged, and the centres relieved of their weight by a locking movement acted upon by a lever; the crane then becomes an ordinary lifting crane.

Naylor's double steam hammer, also manufactured by the Kirkstall Forge Company, which need not be further mentioned here, as the inventor will himself read a paper on the same before this meeting. It is, however, too important a feature in the Exhibition for me to pass without notice.

In the machinery room we find a fine collection of engineers' tools, the manufacture of which has now become a most important branch of our local industry, the town of Leeds now ranking among the first in the empire in this peculiar branch. Most of the machines in this class will be found substantially built, exceedingly well got up, and the quality of casting admirable. A lathe for turning irregularly formed pieces of wood, and an endless tape saw, by Greenwood and Battey; and the beautiful adaptation of Combe's expanding pulley in the drilling machine of Joshua Buckton and Co., are well worthy of notice; of Combe's expanding pulley no more need be said here, the inventor having himself read a paper on it, showing its applicability to various purposes.

The woollen cloth dressing machinery, by Kempe and Co., should not be left unnoticed, though, perhaps, it may possess more of a local than general interest. Taylor's Corn Mill, with the upper stone stationary, the lower one revolving, is remarkable for simplicity and compactness of arrangement. They can be taken up and put down with great facility by the commonest workman, with the aid of a wrought-iron portable crane. Their smoothness of motion, nicest accuracy of adjustment, and simple movements, render them easy to manage, and not liable to much wear and tear. An improved quality of work is obtained by the centrifugal force imparted to the article being ground by the revolving under-stone, in clearing them of the ground substance, also producing a thorough draft or ventilation, thereby grinding at a lower temperature. The stones are 2 feet 8 inches and 3 feet diameter, weighing 3 to 5 cwt. each, versus 15 to 20 cwt., the weight of ordinary millstones. They are effectually driven by a 4½ inch belt, which entirely dispenses with all foundations, and materially reduces the cost of masonry; they stand complete in a selt-contained frame, and may be placed on any floor.

The stationary pumping and other engines by Carret, Marshall and Co., should not be passed unnoticed, being well designed and the workmanship first-class.

Leaving the machinery room and ascending to the south gallery, we find in motion Combe's and Smallpage's new double-cam power-loom.

In this power-loom all the movements for plain weaving are obtained from one shaft, perfectly balanced in itself, and revolving at half the speed of the crank shaft of the old loom, the internal and external surface of a pair of double cams being made to act on rollers connected with the going part of the loom. According to the formation of the cams, all the movements of the hand weaver may be imitated with the utmost nicety; a blow may be given adapted to the tenderest linen or the heaviest sail cloth, and a frame made to suit the broadest or narrowest weaving. In the shuttle used in the loom, the weft is packed into the shuttle in the form of a hollow roll, and drawn from the internal surface, by which means, for tender yarns, a shuttle may be used half as thick as the common shuttle, and still carrying double the usual quantity of weft; or for carpet and canvass weaving, a shuttle of the ordinary dimensions may be made to carry four times the usual quantity of weft. By using a thin shuttle in conjunction with a dead pause at the back, the throw of the going part may be diminished one-half, and the number of times which the reed will chafe on the warp reduced in the same proportion by the introduction of the loom and shuttle.

The loom exhibited by John Holmes, also in operation, for working ladies' corsets without a seam (as sample shown), is well worthy of inspection. It differs from the ordinary way of weaving, by the yarn being on several pullies in small quantities, instead of all being on one beam as in the common loom. A brass belt is attached to it pierced with several holes at certain distances, and moves one-eighth of an inch for every four picks of the shuttle. Small pins, four in number, fall in the brass belt at certain intervals, and make the different changes necessary for the production of the several kinds and shapes of cloth for a corset; and the take up or nippers in front of the loom are in the place of a cloth beam, and draw the cloth straight permanently, whether the machine is working cloth at either side or straight across. An inspection of this machine is necessary to comprehend its merits.

Milner's card setting machine is also to be seen at work. Haste's new apparatus for preventing the explosions of steam boilers is well worthy of inspection, being entirely self-acting, enclosed in a case under lock and key. The apparatus is shown complete and in section, exposing its internal arrangements.

A working model of Donnisthorpe's wool-combing machine, made one-quarter the size of the original, is well worthy of inspection. Joy and Holt's self-acting hydraulic engine, worked by the water from the Leeds Water Works' pipes, for the working of the bellows attached to the organ built by Mr. Holt, should certainly be seen. Similar hydraulic engines are used to blow the large organ in our Town Hall.

Open Competitive Examinations.

A paper on this subject was read by Edwin Chadwick, C.B., before the Section of Economic Science and Statistics.

Mr. Chadwick said that in compliance with the request of the committee, he would begin by stating the results of the practical application of the principle of competitive examinations since the last meeting of the Association held at Dublin. He would, however, in the first place, recapitulate the chief economical principles involved in this question. The first of these was the application to services of the principle which Mr. Babbage, in his treatise on the Economy of Manufactures, had exemplified as applicable to manufactures or commodities, and which he expressed as the "saving of the labour of verification;" of which Tower-proof marks for fire-arms, Hall-marks for plate, coinage for metals, were examples, serving for the verification of the attainment of given standards. The application of the principle to the public service would often save the expense of appointing two or three persons to perform work that might be better performed by one of assured qualification,—appointing for new work a number of persons, as on boards, on the chance that one might be found specially qualified, and take the lead in the performance of the required service. And the like economy was applicable to private service. Thus, from the collateral or direct application of the principle to the testing of efficient or inefficient schools, the economy to parents, in obviating the almost total loss of their investments in the education of their children—the economy of time, not to speak of greater considerations belonging to the moralist,—to the children themselves would be enormous; for, added to these economies, there was the economy of time to the pupil or the parent in having authentic and definite standards of the required qualifications, and the great economy of time in attaining them effected by the impetus of competition. For the attainment of these economies the mere pass examination, to a fixed minimum standard, was proved to be generally untrustworthy, and often fraudulent. The cram sufficed for the mere pass examination, but with a properly regulated verbal, as well as written, open and public competitive examination, cramming, in Mr. Chadwick's opinion, was impossible. He would now state in answer to the expectation of the section of its meed of statistics—that of the chief open competitive examinations publicly and properly notified as open to all comers, they had as yet no recent statistics. There were on the average about twenty writerships given to open competition, and as many medical appointments; then there were about thirty cadetships at Woolwich—in all, perhaps, about seventy or eighty situations annually—which were at present the subject of *bonâ fide* open competition. The opening of the cadetships of the Engineers and Artillery for the Indian army would give perhaps as many more as at Woolwich. The only competition of this character for the civil service during the last year had been one—only one—for a single clerkship, at the disposal of the Civil Service Commissioners themselves, and described at some length in their last report, with their statement of reasons, the result of prolonged observation, for the principle of their preference for full, open, and public competition, in accordance with the resolutions of parliament, to the nominated competitions which they had been required to conduct. These nominated, or, properly speaking, the close patronage-appointed competitions, appeared to be on the average of three candidates for one place. The vacancies were unnotified and unknown to the educational institutions or the general public, and the candidates were named by the departments. The results of competitions in which there were both patronage-appointed and open-competition candidates were very much in favour of the latter. Nevertheless, in the face of clear proofs of the benefit it was calculated to confer, it had been determined to suppress the principle of open competition for army commissions, by restricting it to nominated cadets. It was alleged in the House of Commons, by public officers, that there was no intention to do so, but this must be a mistake. Mr. Chadwick dwelt at considerable length upon the importance of the general principle of making all appointments according to merit, and quoted from various reports and other documents to show the evils that had in many cases arisen from following a different course. With regard to the effect of competitive examination upon the candidates themselves, Professors Galbraith and Houghton, in their published report in respect to the last Woolwich examinations, had stated:—" As a proof of the benefits conferred by the competitive system, we may mention that subjects hitherto neglected, and some never heard of, in Irish schools are now particularly attended to and diligently taught. We may specify English and French literature and certain advanced branches of science, such as mechanics and hydrostatics. The effects of this system on the study in the university are most striking. We have been fellows of Trinity College since 1844, and have never witnessed anything like the exertions to acquire knowledge made within the last two years. The effect on the teachers is no less remarkable than on the learners. We all feel that our honour is at stake in sending forward candidates to these public contests, where the youth of the entire kingdom assemble for competition." This had been corroborated in other reports. The evils resulting from patronage in another branch of public service, diplomatic appointments, were then pointed out, and instances of the incompetence of several who had held high positions were given. This had been particularly the case with regard to consuls, in the appointment of whom there had been great abuses. The French, on the other hand, had adopted securities for the qualification of their consuls, tested by examinations on the principles proposed. A consul should carry with him, for the public service, a knowledge of the legal institutions of his country, and obtain an acquaintance with the legal and municipal institutions of the country where he resides. The French regulations required that the consul should have the diploma of an advocate, which was only obtainable upon real examinations; and, moreover, that he should have a special knowledge of French treaties, and professional ability in dealing with the questions which arose out of their nonobservance. Mr. Chadwick replied at some length to objections that had been urged against the system he was advocating, on the alleged ground that its introduction tended to lower the average of the physical qualities possessed by those who obtained appointments, and continued as follows:—" Since we last met the principle has made progress in unexpected directions where it will have important bearings in political relations of the empire; for an act has been passed by the legislature of Canada 'For improving the organisation and improving the efficiency of its civil service,' which act adopts our principle of special qualifications for the service tested by open competition, before a board of examiners, as proposed in England. The principle has also been introduced into Malta, under the auspices of the enlightened governor, Sir William Reid, who reports, 'I continue to be of opinion that the system of giving clerkships under 22 years of age, to those who pass the best examination, is working advantageously for Malta, and the competition created is evidently having the effect of improving the schools.' I am informed that, with others of our administrative reforms, the principle of open competition is under consideration for adoption in Australia. I beg leave to submit that the course taken by the legislature of Canada, as well as that indicated in Australia, is of the highest import for the advancement of economic science and public administration, for the preservation of representative institutions from degradation, as well as for the educational and political progress of the colonial population. The first effect of the principle of open competition is in getting rid of the obstructive operation of great, and in the colonies peculiarly odious, irrelevancies—as I term them. What it would be in this association, if we were, on questions of science, to enter into the professor's theological or political opinions, or those of his parents, if for example, before considering the views of a professor on electricity, which he has deeply and profoundly studied, we were to discuss his views on politics or theology, which he probably cannot have studied, but will probably have taken on credit—as it would be with the progress of sciences here, so it is, to the extent to which it prevails in public administration. In Ireland how odious is it to see in times when one party is predominant, the service of the engineers or the artillery deprived of the superior qualifications of a graduate of Trinity College, Dublin, because his father is a Protestant and an Orangeman; or, on the predominance of another party, to see shut out a young man of superior acquisitions in engineering science, because, like his parent, he is a Roman Catholic! As we make progress in art and science, greater and greater devotion is required to divisions and subdivisions of labour, and this attention to those subdivisions almost precludes attention to other wide general controversial questions of politics or theology, and almost necessitates their adoption on trust, and makes the perseverance in the adoption of those irrelevancies as tests, the more odiously unjust towards the young. The competitive principle, as testing the qualifications for the specialities of service, avoids all this. In Canada, it must avoid hateful feelings and jealousies of mere race. In Australia it will assure the young and best qualified candidate, that if, upon the prolonged probation—which is the adjunct of our principle —his own conduct displays his purification, he shall be as little prejudiced by his antecedents as if he were a descendant of one of our greatest historical scoundrels and traitors—amongst whose descendants, or such of them as remain to show—as many of them do show, in an exemplary manner, the purifying influence of the time and civilisation—our great historical depictor of their progenitors, Lord Macaulay, is sent to associate. The principle, in its operation in those colonies, is a bounty on moral purification. At the same time, in counteracting noxious anti-social irrelevancies to the proper object in hand—the principle tends, by freeing the exercise of special qualifications from their disturbance, to facilitate those applications of science to the improvement of administration, of which one condition of progress is permanence in their prosecution. The development of the principle of government by the great irrelevancies of general political party principles, as against special qualifications, may be seen on a gigantic scale in the United States. I have received, from very able officers, either of the State or general government, inquiries on questions of administrative improvements, which I have had specially to consider; such, for instance, as the application of sanitary science to the improvement of the population; improvements in the statistics of administration, for which most important fields were opened in America. But, on inquiry as to their progress, I have been informed that they had been ejected by a change of political parties, and that the attempt was extinguished. Under such conditions, the introduction of improvements of a scientific character in public administration appears to me to be generally hopeless. The effect of the frequent changes of the political chiefs of departments in England is bad enough; but in the United States the whole of the office holders—all of one class of permanent civil servants, are dismissed with each presidential change of party, and the entire service of the country is held up as the spoil of party conflicts; and during the short tenure of office those who gain that spoil are led to extend it beyond the direct emoluments of their office. According to authentic reports—according to the statements and lamentations of respectable Americans, the friends of progress, in no legislative or administrative bodies in the old country is there so much bribery and corruption; the character of the judiciaries as well as the legislation and public administration has been degraded, and on account of their failure a recourse to Lynch law, and vigilance committees and armed violence, has often become a matter of necessity and a reactionary corrective. Now, the course approved by the Canadian legislature, of holding out public offices as prizes for the advancement of education, and for acquirements in their schools of those qualifications which are equally available for the private and open professions, and withdrawing the public emoluments as prizes for conflicts of party passion and violence on political platforms, is the best measure for preserving free representative institutions from degradation, and ensuring to that great colony a rate of advance in social as well as political progress which, under the existing conditions of the United States, must be hopeless, unless the contending parties can be brought to consider the principle, to concede to their educational institutions the rewards which they will not yield to each other. For these reasons, and for stimulating and testing the progress of their rising educational institutions, the principle may be solemnly commended to the earnest consideration of all our colonial legislatures as well as to our relations in the United States." After giving instances to show the illusory character of the nominated close competitons, of twos and threes for one office, he said he felt it his duty to represent that the principle was in hostile executive hands, and that it behoved all friends of education and science to exert themselves with the public, and press upon their representatives the necessity of its extension to all junior appointments in every branch of the service, to demand public notification of all vacancies, and an open and fair field, without political favour, for the proved capacities of the country.

HOROLOGICAL INSTITUTE.

A Horological Institute has been established in Clerkenwell, the object of which is to develope the science of Horology, to foster the arts and various branches of manufacture arising out of it, and to stimulate and encourage the production of the best workmanship by suitable rewards and marks of distinction; and to attain these results by the formation of a library, reading-room, and a collection of tools, models, and machinery; also by the delivery of lectures, and the reading of original papers on subjects connected with the art of Horology and the various branches of trade or manufacture connected therewith. A monthly journal is issued by the Society.

PRESERVATION OF ANIMAL AND VEGETABLE SUBSTANCES.

A patent has lately been taken out for effecting this object. The improvements consist in coating animal and vegetable substances with a compound formed of vegetable albumen and a suitable antiseptic material. The coating is effected by immersing the substances to be preserved in the prepared compound two or three times, each coating being dried or set in a current of air before the next is applied. The object of combining an antiseptic agent with the vegetable albumen is to prevent a partial decomposition of the substances occurring before the protective coating is properly hardened. The following means may be adopted for carrying the invention into effect:—Supposing a joint of meat to be the substance to be preserved, the meat (with as much of its blood extracted as possible) is first washed or immersed in water impregnated with acetate of alumina and allowed to drain, it is then suspended by a string, and allowed to descend into a bath composed by placing about one pound of gum adraganthe (or gum dragon) in from one and a-half to two gallons of heated water for about twenty-four hours, straining the solution, then mixing with it a warm solution of about six ounces of gelatine or paste, and finally adding about ten ounces of acetate of alumina, mixing and straining. The meat is kept in this bath for about two minutes, being drawn and moved about in it by the string, it is then taken out and suspended in a current of dry air for about twenty-four hours. The process of immersion, &c., is then repeated once or twice, as may be considered desirable.

ANALYSIS OF METROPOLITAN WATERS.

The Registrar General in his last report makes the following statement:—

The waters supplied to the metropolis have been examined during the month of August by Dr. Robert Dundas Thomson, F.R.S., of St Thomas's Hospital, who found their composition to be as exhibited in the subsequent table. It will be observed that the amount of impurity in each water is less than in any previous month of the year, in consequence of the great dryness of the period to which the analyses refer. A comparison of the present with former tables will show how far the condition of the waters is improving. For the sake of comparison, the composition of Glasgow waters is appended. The inhabitants of that city are not satisfied with the Clyde supply, though much cleaner than that of the Thames, and the water of a Highland lake, approaching distilled water in purity, will soon flow into the city by gravitation.

—	Total impurity per gallon.	Organic impurity per gallon.
	Grs., or °.	Grs., or °.
Distilled water	0·0	0·0
Clyde, present supply at Glasgow	9·57	1·08
Loch Katrine, new supply to Glasgow	2·15	0·80
THAMES COMPANIES:—		
Chelsea	15·88	·92
Southwark	16·00	1·96
Lambeth	17·40	1·08
Grand Junction	16·40	1·72
West Middlesex	15·36	1·28
OTHER COMPANIES:—		
East London	16·68	1·60
New River	15·52	1·32
Kent	22·60	1·88

This table exhibits the amount of foreign matter contained in each gallon of water expressed in degrees or grains. The samples were all taken from main pipes.

WHITE BRASS, OR UNOXIDIZABLE CAST IRON.

M. Porel, of Paris, has prepared an alloy which has the appearance and fracture of ordinary zinc, but it is as hard as copper or iron, and tougher than cast iron. It may be turned, filed, or drilled, as easily as those metals; does not adhere to metal moulds, and retains its metallic lustre perfectly in a moist atmosphere. This alloy is prepared by melting together zinc, copper, and cast iron. It contains 10 per cent. copper and 10 per cent. iron. This alloy may be used for various purposes in the construction of machinery; it may be made to appear like bronze, either by covering it with a deposit of metal, or by throwing up the copper superficially, and is, therefore, well adapted for casting vases, statues, and other objects of artistic character that are to be exposed to the atmosphere, especially as it is not a costly material.—*Mining Journal.*

Proceedings of Institutions.

GRAHAM'S TOWN (CAPE OF GOOD HOPE).—The third annual report of the Literary, Scientific, and Medical Society, states that the fortnightly meetings have been regularly held, except during the period of vacation from December, 1857, to April, 1858, and lectures have been delivered of a varied and instructive kind, on different literary and scientific subjects. In these lectures, Agriculture,—a subject of much interest to the colony, has been brought prominently forward. The current session was begun with increased activity. The introductory lecture was kindly delivered by the Lord Bishop of Graham's Town, to a very large audience, and considerable interest has been taken by the members in all the subsequent lectures. In October and November last, a series of object lessons was given to a number of young persons, by Dr. Edmunds, Messrs. B. Glanville, and McDonald, the design being the illustration in a simple and popular style of the contents of the Museum. The attendance was very favourable, the teachers of several schools having availed themselves of the opportunity to bring their senior pupils to these lessons. Many valuable specimens have been added to the museum, but in consequence of maintaining it on the slender means which the society could afford, the liabilities of the society have considerably exceeded its limited income, and the committee applied a short time ago for pecuniary aid from the government; this application was favourably received by the Governor, who caused to be placed upon the estimates, for the support of the museum, the sum of £150 as an annual grant. The following is a list of lectures delivered:—Mr. McDonald, "On Meteorology;" Mr. Kennelly, "On Music;" Rev. J. Heavyside, "The Merovingian Era;" Mr. Glanville, "Hugh Millers' Work; the Testimony of the Rocks"; (two lectures), Mr. G. Wright, "Retrospect of History;" Mr. W. Young, "Poetry of Mrs. Hemans;" Mr. Kennelly, "Music" 2nd lecture; Mr. J. Standen, "Phrenology;" Mr. Franklin, "Reminiscences of Travel;" The Lord Bishop of Graham's Town, "Introductory Lecture to Session of 1858;" Mr. McDonald, "Moral Philosophy;" Mr. Glanville, "The causes of the present efficient state of Agriculture in Great Britain and other Countries;" Dr. Edmunds, "Our Food, Animal and Vegetable;" Rev. E. Cornford, "Domestic and Social Life of the Ancient Greeks;" Mr. Tudhope, "Agriculture." An Art exhibition has been lately held in the society's-rooms, embracing an extensive collection of pictures, engravings, and articles of virtu, which has attracted much attention in the colony.

Leeds (Christian Institute).—On Tuesday evening, 28th September, a soirée in connection with this Institute was held in the Stock Exchange Hall. The Right Hon. M. T. Baines, M.P., occupied the chair, and was surrounded by Sir John Herschel, Sir R. I. Murchison, Rev. Dr. Booth, Dr. Gladstone, Rev. J. Blomefield, Rev. H. R. Reynolds, Rev. G. W. Conder, Rev. W. Guest, Rev. S. Hulme, Rev. J. D. Brocklehurst, &c., &c. The Right Hon. M. T. Baines, on rising to address the meeting, said he assured them that he had the greatest pleasure in attending there that night for the purpose of testifying the very great respect—the heartfelt respect which he entertained for themselves and for the object which he understood they had in view in that institution—that object, unless he was mistaken, being to enable young men to combine the cultivation of all the graces of a truly Christian character, with the improvement of their intellectual powers, and the attainment of really valuable knowledge. In the course of his address, he observed that that institution, for the superiority of its class instruction and success of its pupils, was found to stand the third in the kingdom according to the Society of Arts' returns. They had eleven pupils who obtained certificates, two first-prize men, one second-prize man, and one of the former who had obtained in addition, at the Oxford Examination, the degree of A. A., and prize of £5 from the delegates of the Oxford Board. These facts, though they lay in a very narrow compass, bore, in his opinion, a most valuable testimony to the operations of the society, and entitled it to the cordial good wishes of all who could appreciate self-denial, industry, and Christian principle. The chairman concluded by introducing Sir John Herschel, who was received with great enthusiasm. He said that when he was invited to attend that meeting, he understood that he should be called upon to distribute the prizes for astronomy to those young men who had distinguished themselves by their attainments in that science in the Society of Arts' examinations. That arrangement, however, had been very properly altered, and the prizes being considered as distributed, he felt himself at liberty to choose the ground upon which he should address the meeting. As a member of the Society of Arts, his opinion had been requested as to the system of examination, and he gave it most cordially in favour of the proposed scheme; and he stood there, therefore, not merely as a casual visitor, but as one having some more special interest, at least in one part of their proceedings. As a member of the Society of Arts, he must, in the first instance, express his gratification at the well-working of the system in this particular instance; and in the next place, he thought he ought to congratulate the Leeds Young Men's Christian Institution upon the success achieved by several of its pupils in the examination. With these remarks he might proceed, but he should confine his observations to the general testimony which science bore in favour of religion, a testimony which, speaking in the name of science, he had never been backward to give, and which he should never shrink, either on that or any other occasion, from giving. Sir John Herschel then directed his observations especially to the encouragement of those young men who had distinguished themselves in the particular branch of science to which he was himself devoted, astronomy, and concluded by proposing the following resolution:—"That this meeting recognises with pleasure the efforts so successfully made in the Young Men's Christian Association to unite the cultivation of science and literature with the nourishment of true virtue and spiritual religion." Sir R. Murchison seconded the resolution, and, in the course of his remarks, said he was anxious to impress upon the members of that Institution the importance of cultivating, as much as was in their power, an acquaintance with geology. He was glad to learn that there was a geological institution at Leeds, and he should be most happy, as director-general of the Geological Survey of the British Isles, to assist that particular Institute by every means in his power. He promised to send to it all the volumes connected with the illustration of the geology of the British Isles which were within his control, and this, he hoped, would prove his good will and sincerity in the cause they were met together to celebrate. The Chairman then distributed the prizes and certificates awarded by the Society of Arts to members of the Institute. The Rev. Dr. Booth, in supporting the motion, observed that he could not recollect any period in the history of this country when so many inducements and so much encouragement were held out to the working and middle classes to promote their own self-improvement. In his opinion, the great work of self-improvement was not to be done for them, but by them. No one would deprecate more than he would the pursuit of mental improvement with the sole object of raising themselves in life, or obtaining any particular situation. They must study irrespective of these considerations, and with a determination above all to do their duty. The Rev. H. R. Reynolds moved the following resolution:—"That this meeting heartily welcomes the delegates now present from the Young Men's Christian Associations of Great Britain and Ireland, and extends its cordial Christian sympathy and best wishes to the Associations they represent." The Rev. J. Blomefield seconded the resolution, and the meeting was afterwards addressed by the Rev. T. H. Tarlton, Dr. Gladstone, the Rev. M. Brocklehurst, the Rev. S. Hulme, and Mr. W. E. Shipton. Mr. T. A. Pane moved, and Mr. Dawbarn, of Wisbeach, seconded, a vote of thanks to the chairman, which was duly acknowledged, and the meeting then separated.

Leeds (Mechanics' Institution).—A soirée took place in the Leeds Town Hall, on Wednesday evening, the 29th ult., under the auspices of the Mechanics' Institution and Literary Society, at which were distributed the prizes and certificates of the Society of Arts awarded at the late examination to students from that Institution. Long before the hour fixed for the meeting the hall was crowded in every part. Lord Goderich occupied the chair, and amongst those present were the Earl of Carlisle, Sir R. I. Murchison, Sir P. Fairbairn, Sir C. Nicholson (Provost of the University of Sydney, Australia), Right Hon. M. T. Baines, M.P., Professor Owen, Mr. R. M. Milnes, M.P., Professor Phillips, Professor Hennessy, Dr. Norton Shaw, Rev. Dr. Booth, Rev. Dr. Hook, Mr. E. Chadwick, C.B., Admiral Fitzroy, F.R.S., Admiral Grace, Dr. Lee (President of the Meteorological Society), Mr. Ald. Oxley, Mr. Ald. Bateson, Mr. Ald. Blackburn, Mr. Ald. Botterill (President of the Institution), Mr. Ald. Kelsall, Rev. C. P. Chretien (Oxford), Rev. H. R. Reynolds, Rev. G. W. Conder, Rev. J. H. Ryland (Bradford), Mr. E. Baines, Mr. J. Hole, &c., &c. The Chairman said, he had little doubt that many of whose who attended the last annual meeting of the Leeds Mechanics' Institution would have thought that that meeting was likely to have been one of the most memorable that ever was held in connection with this body; for it was difficult to have supposed that anything could have equalled that assembly, presided over by Lord Brougham, a man eminently distinguished as a friend of science, a statesman, and a lawyer. He thought, however, that no meeting of this Mechanics' Institution, or, indeed, of any other, had ever been held under more favourable auspices than this; for that evening, the objects of the Leeds Mechanics' Institution were sanctioned by the presence of some of the most distinguished men, he would not say of England, but of the civilised world, who had consented to be present on this occasion, in order that they might show that they, at all events, were hearty approvers of the work in which Mechanics' Institutes were engaged. With regard to the present state of prosperity of the Institution, he found that the Leeds Mechanics' Institution was possessed, at the present moment, of 1,600 members, and that its yearly income amounted to the large sum of £3,000. Besides these, there were no less than 90 scholars in the boys' school, 60 pupils in the boys' evening class, 80 scholars in the ladies' educational institution, and 30 in the ladies' evening class; so that they would see that the benefits of the Institution extended to a very wide circle indeed. In addition to the pupils of whom he had spoken, there were connected with the Institution no less than 2,200 persons, the pupils of the School of Art. There was no doubt that the Institution was doing its work efficiently, and the best practical proof that could be given of this was the distribution of certain prizes which had been won by the members of this Mechanics' Institution in close competition with the other institutions of the country. In spite of this, however, he found that in order to carry out their extensive operations, the managers had been obliged to incur debts. He had been requested, however, to take this opportunity of informing them that it was intended, next year, to hold a bazaar for the benefit of this Institution, and that that bazaar was to be held under the patronage of Her Majesty the Queen. His lordship then alluded to the Royal visit to Leeds, and expressed his opinion that no one who had been present on that occasion, and had seen the order, the good temper, and the loyalty which were displayed by the half-million of the working classes who then thronged the streets—no man who witnessed that most glorious and striking scene, could have doubted, if he had compared it with such visits in former times, that there had been the working of some potent influence and some elevating improvement upon the people of this county; and he could not doubt that among them one of the most powerful had been the spread of education. To that work Mechanics' Institutes had materially contributed, as well as those other gratifying circumstances which they had lately witnessed—that fortunate union among all classes, that happy intercourse and good feeling and mutual confidence between employers and employed which had been spread of late far and wide. — The Earl of Carlisle proposed the following sentiment:—"Success to the Leeds Mechanics' Institution and Literary Society, and all similar societies, as they materially promote the development of the chief sources of intellectual cultivation." He would not himself speak on the subject of Mechanics' Institutions, but what he had to say would be entirely of a local and personal character. He had himself followed the fortunes of the good town of Leeds, as well as of the cluster of sister communities which formed the West Riding, and although they undoubtedly had been of a chequered character, as the gleams and shadows of peace and war, of panic and activity, had alternately flitted over them, yet the whole result conveyed to him was that of increasing enterprise, of triumphant industry, and of growing greatness. Above all, he had rejoiced to perceive the evidences of moral progress, as it had been testified by the encouragement given to education, by the multiplication of Mechanics' Institutes, literary societies, and schools of art, by the added facilities for public worship, and by the spirit of order and obedience to the law which had distinguished these swarming hives of industry. — Sir R. I. Murchison seconded the resolution, particularly alluding, in the course of his address to the meeting of the British Association at Leeds. The Rev. Dr. Booth spoke upon the sentiment—"That the present movements in education tend to encourage the working classes to promote their self-improvement." He remarked that when they had previously discussed the question, how Mechanics' Institutes were to encourage self-improvement, their arguments were little better than reasons in support of a speculative theory, which theory was now no longer such, but was based upon experimental facts. He should not enter into the discussion of the arguments by which this system was recommended, not only as supplying a number of young men, highly cultivated for the public service, but still more as affording the greatest possible stimulus to national education. He would, however, in his anxiety for the success of this measure, address to them one or two cautions. First, they might examine too much, because the processes of the mind in acquiring knowledge were directly opposed, he might say, to those for its manifestation; and, therefore, he should shrink from seeing the system of examination extended to very young boys. He would also press upon them another caution, strongly advising them that if they had laid a sound foundation of elementary knowledge, they should endeavour to build upon it some massive and simple structure, dedicated to one or two departments only of intellectual worship, instead of attempting to embrace too many subjects, which would only lead to their knowledge being superficial.—Mr. Chadwick supported the resolution.—Lord Goderich then proceeded to distribute the medals awarded by the Department of Science and Art. His Lordship next distributed the prizes and certificates awarded by the Society of Arts to successful candidates at this year's examination.—Professor Owen then proposed the following sentiment: "The advancement of science—to the steady pursuit of which Britain owes much of her elevation among the nations of the world;" this was seconded by Sir Charles Nicholson, provost of the University of Sydney, and late Speaker in the Legislature of New South Wales. He said he had, for upwards of twenty years, been connected with an institution similar to the Leeds Mechanics' Institution in a very remote part of the world—he alluded to the Mechanics' Institution of Sydney—an Institution which, when he first joined it, did not number more than 20 or 30 members, but now comprised 1,200 or 1,300. For this reason, as well as for the deep interest which Australian colonists must feel in all that related to Leeds, he had been induced to take part in that meeting. —Mr. R. M. Milnes M.P., proposed the next sentiment, which was as follows:—"The extension of Schools of Art, as they impart a taste for artistic beauty, and give familiarity with the principles on which it rests."—The Right Hon. M. T. BAINES, M.P., expressed his hearty concurrence in the sentiment.—Admiral FITZROY, head of the metropolitan department of the Board of Trade, submitted the next sentiment:—"That the union of different classes and parties in these institutions tends to the removal of prejudice, and the cultivation of friendly feelings."—Dr. NORTON SHAW also addressed the meeting on the sentiment, which was supported by Professor CHRETIEN, who briefly alluded to the Oxford Examinations.—Sir PETER FAIRBAIRN, the mayor, proposed a vote of thanks to Lord Viscount Goderich for his services in the chair.—The resolution was seconded by the Rev. Dr. HOOK, and carried by acclamation.—Lord GODERICH acknowledged the compliment.—Alderman BOTTERILL proposed the following resolution:—"That the thanks of this meeting be given to the distinguished visitors who have honoured us with their presence this evening."—This was seconded by Mr. EDWARD BAINES, who observed, in the course of his speech, that he could not but characterise this as the most brilliant assemblage that had ever been held under the auspices of the Leeds Mechanics' Institution.—The Earl of CARLISLE returned thanks for the compliment paid to the visitors, and the meeting separated.

NEWCASTLE.—Mr. W. G. Armstrong, of Elswick, through Mr. Dees, the treasurer, has intimated to the committee that he has placed £1,200 at the disposal of the Literary and Philosophical Society, to be applied to the erection of a reading-room.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Oct.* 1, 1858.]

Dated 5*th August*, 1858.

1778. J. Luis, 1B, Welbeck-street, Cavendish-square—A new waterproof tube without seams or rivets, and in the apparatus connected therewith. (A com.)

Dated 7*th August*, 1858.

1800. J. Luis, 1B, Welbeck-street, Cavendish-square—A new twisting bobbin. (A com.)

Dated 26*th August*, 1858.

1930. W. Evans, Sheffield—Imp. in machinery or apparatus for manufacturing saw backs.

Dated 30*th August*, 1858.

1962. B. Hanson, Paddock, near Huddersfield—Imp. in means and apparatus for sizing and drying woollen yarns for warps.

Dated 2*nd September*, 1858.

1994. J. Bleakley, Accrington, Lancashire—Imp. in apparatus for communicating between the guard and engine-driver of railway trains.

Dated 4*th September*, 1858.

2008. D. Andrew, Greenock—Imp. in apparatus for obtaining motive-power.

Dated 9*th September*, 1858.

2040. W. Prisley, 7, Townley-place, Brandon-street, Walworth—Advertising by day or night.

Dated 10*th September*, 1858.

2052. J. Knowles, Bolton-le-Moors, Lancashire—Certain imp. in machinery for preparing cotton and other fibrous materials.
2056. F. A. E. Guironnet de Massas, Gerrard-street—An improved machine for decorticating and cleaning grain and seeds.
2058. D. Cheetham, Rochdale Imp. in machinery or apparatus for preparing for spinning, and spinning cotton, wool, and other fibrous materials.

Dated 11*th September*, 1858.

2060. P. Journet, Paris—An improved toy.
2066. J. L. Hinks, Birmingham—A new or improved tap or cock for drawing off and filtering liquids.
2068. W. H. Manning, Devizes—Imp. in candlesticks for holders.
2070. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of soda and potash.

Dated 13*th September*, 1858.

2072. G. Flageollet, Vagney, France—Imp. in self-acting mules.
2074. C. W. Siemens, John-street, Adelphi—Imp. in refrigerators, and in the treatment of the freezing or cooling material or materials used therewith.
2078. J. W. Towell, Regent-street—An improved helmet.

Dated 14*th September*, 1858.

2080. W. Riley, Bradford—Certain imp. in looms.
2082. J. Luis, 1B, Welbeck-street, Cavendish-square—Coke and gas kilns. (A com.)
2086. R. Lakin, Ardwick, and J. Wain, Manchester—Imp. in spinning mules and other machines of that class, used for spinning cotton and other fibrous substances.
2088. S. St. Clair Massia, Pall-mall—Imp. in stoves or fireplaces. (A com.)

Dated 15*th September*, 1858.

2090. Capt. F. Fowke, R.E., Park-house, South Kensington—Imp. in fire-engines.
2092. E. Dorsett, Old Broad-street—A portable carriage tank and furnace, to be employed for the purpose of creosoting hop poles or other timber.

Dated 16*th September*, 1858.

2095. G. Redford, Moseley, Worcestershire—Making cartridges of metal or gutta percha, with or without bullets, and for other purposes.
2096. R. Allison, Gravesend—Imp. in apparatuses for boring and sinking.
2097. W. P. Struvé, Swansea—Imp. in apparatus for indicating strains on engine ropes or chains.

Dated 17*th September*, 1858.

2099. C. F. Vasserot, 45, Essex-street, Strand—Machinery or apparatus for dressing and finishing fabrics. (A com.)
2101. E. Welch, Saint John's-square, Clerkenwell, and J. Biggs, Norton Folgate—An improved tobacco-press.
2103. J. H. Gresham, Kingston-upon-Hull—Imp. in copying letters, invoices, and other writings.

Dated 18*th September*, 1858.

2105. J. Luis, 1B, Welbeck-street, Cavendish-square—Imp. in the application of gutta-percha for clogs, galoches, shoes and boots, and for the apparatus connected therewith. (A com.)
2107. J. G. N. Alleyne, Butterley Iron Works, Alfreton, Derbyshire—Imp. in the manufacture of wrought-iron beams and girders.
2109. A. Turner, Leicester—Imp. in looms for weaving.
2111. T. Vicars, senr., T. Vicars, junr., T. Ashmore, and J. Smith, Liverpool—Imp. for the consumption of smoke in moveable furnaces or chauffers, for heating bakers' and other like ovens.

Dated 20*th September*, 1858.

2113. H. Barrow, Birmingham—An imp. or imps. in cartridge boxes.
2115. E. Riepe, Sheffield—An imp. in the casting of steel.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2128. F. F. Emery, Massachusetts, U.S.—An improved sewing machine. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Oct.* 1, 1858.]

September 30*th.*

496. A. Porecky.
579. L. Cowell.
673. T. Silver.
686. J. Mercer.
687. F. Edwards and W. Edwards.
701. C. G. Russell.
702. T. F. Robinson.
710. J. Fowler, jun.
713. H. Cartwright.
722. J. Smith.
724. S. Fox and J. Chesterman.
735. D. Davy, W. Bentley, and J. Davy.
740. E. P. Sibille.
743. W. A. Gilbee.
745. W. Armitage and H. Lea.
750. J. Doherty.
751. C. F. Whitworth.
754. J. Cartwright.
755. G. Davies.
756. G. E. Taylor.
757. G. Rowland.
758. F. W. Mowbray and J. Broadley.
762. T. Greenwood and J. Batley.
765. W. R. Jackson.
767. H. Bayley and J. Greaves.
771. R. M. Ordish.
772. A. Lees and D. Schofield.
776. J. Oxley.
777. S. T. Parmelee.
784. J. Rae.
785. A. C. Thibault.
813. A. V. Newton.
815. F. Preston and W. McGregor.
821. J. Harris & T. Summerson.
825. P. Brotherhood.
847. W. Latham
852. W. Bullough and J. Harrison.
864. R. Peacock.
870. J. Adkins and T. O. L. Buss.
888. H. A. de Saegher.
895. T. Greenshields.
909. W. A. Clark.
936. W. Keiller.
982. C. Schleicher.
993. D. Thom and G. A. Phillips.
1004. M. Davis.
1010. T. W. Thacker.
1126. J. Copcutt.
1179. J. Luis.
1198. S. Osler.
1236. J. Luis.
1328. G. Bartholomew.
1386. R. Winans and T. Winans.
1387. R. Winans and T. Winans.
1388. R. Winans and T. Winans.
1389. R. Winans and T. Winans.
1526. G. A. B. Chick.
1641. J. von N. S. Petrziwalsky.
1692. T. Line.
1738. G. T. Bousfield.
1801. J. Luis.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Oct.* 1, 1858.]

September 27*th.*

2166. R. Robey and G. L. Scott.

September 29*th.*

2180. C. Radcliffe.
2184. W. Kempe.

[*From Gazette, Oct.* 5, 1858.]

October 1*st.*

2198. J. Bernard.
2227. W. Spence.

October 2*nd.*

2209. R. Wilkinson.
2230. T. Dickens.